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AUTHOR Johnson, Judith; And Others
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ABSTRACT

This paper describes a collaborative project among graduate students, university faculty, administrators, and science teachers in an urban public school district. The project has been funded by Eisenhower (Title II) monies, the Omaha Public Schools, The University of Nebraska, and the National Science Foundation (NSF). The goals for this project were to assist teachers in reconstructing their curriculum to be culturally relevant and to improve science learning for all students, including the economically deprived, minorities, and females. A series of 4-week summer workshops were held involving teams of teachers from middle and high schools and an administrator from each school. The goal of the workshops was for teachers to utilize the information and experiences gained from these activities to create short (2-3 day) and long (2-3 week) curriculum units which were presented and critiqued by the entire group. The resulting refined curriculum units exist in a large data base and are being field-tested in the teacher's classroom during the academic year and in summer school. Each year approximately 50% of participants return. When the NSF funding ends in 1994 it is estimated that approximately 50% of the secondary science teachers in the Omaha Public Schools will have developed, field-tested, and refined innovative and culturally relevant curriculum for use in grades 7-11 in their school district. (PR)

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Multicultural Science Education Project: A Model of Reform

Judith Johnson, University of Central Florida
Elizabeth Kean, University of Nebraska, Lincoln
Carol Mitchell, Omaha Public Schools

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Multicultural Science Education Project: A Model of Reform

There have been many influential reports which decry the serious shortcomings in elementary and secondary science education (American Association for the Advancement of Science, 1989; National Assessment of Educational Progress, 1988; Task Force on Women, Minorities, and the Handicapped in Science and Technology, 1988). The statistics reveal an alarming disparity in the way education is distributed among students. Although the drop-out rate is in itself alarming, the seriousness of the problem is reflected in the disproportionate number of drop-outs who are minority students, children from poor economic conditions, and students whose parents do not speak English. This may be a reflection of their feelings of marginalization and alienation from the academic core curriculum and the resulting low achievement scores and graduation rates (McCarthy, 1990).

While a wide range of explanations exist for the high rates of student failure in science classes, it is true that the current classroom practices neither reflect the changes in social structure nor the current shifts in racial, linguistic, economic and social diversity. Teachers are increasingly being faced with classroom situations for which they are ill-prepared. How can teachers develop more powerful options for teaching students who do not buy into the Eurocentric culture of the school? What are the factors that both encourage and discourage changes in the ways science is taught in schools?

Among the barriers to change are externally prepared "teacher-proof" curriculum and standardized testing which discourage teachers from creating effective curricula and pedagogical practices and from designing assessment instruments appropriate for their teaching objectives. Additionally, these curriculum reforms tend to increase teacher isolation and feelings of alienation from the reform movements, resulting in the current pervasive problems in science education.

Culturally relevant teaching in the science classroom is related to other critical issues in the educational reform arena including teacher and curriculum change. Curriculum is imbedded in culture and the context of the school (Grundy, 1987), and if changes are to be implemented and sustained, it is imperative that teachers play the major role in reform. Further, teachers cannot change in isolation from the culture in which they work and therefore reform movements must consider the role of teacher beliefs and learning as they are conceptualized within the context of their professional lives.

Project Description

This paper describes a collaborative project among graduate students and university faculty and the administration and science teachers in an urban public school district. This project has been funded by Eisenhower (Title II) monies, the Omaha Public Schools, the University of Nebraska, and the National Science Foundation. The goals for this project were to assist teachers in reconstructing their curriculum to be culturally relevant and to improve the science learning for all students, including the economically deprived, minorities, and females. Our critical approach

was designed to empower teachers as professionals who can identify and find resolutions for the complex educational problems they face in their classrooms. The curriculum that has been developed and is currently being field-tested and refined, is designed by the teachers to reflect the interests, needs, and learning modalities of the students in their classrooms. Consistent with other school reform movements, this project was governed by the following assumptions:

-All students can learn science. Emphasis is placed on cultural context teaching (Gay, 1977) whereby the students' own background and experiences are considered to teach basic academic concepts. Community members from various ethnic groups assist the participants to confront issues of ethnic differences and similarities. In concert with other activities, the participants are encouraged to confront their own cultural realities and to explore ways that their interpretations of culture influences their teaching and interactions with students.

-Problem-solving, problem-posing, and sense-making must replace repetition and memorization as students' major work in classrooms.

-Alternative instructional strategies that are compatible with diverse learning styles such as cooperative learning and other collaborative models increase teacher effectiveness.

-Community and family involvement are other critical factors that increase the effectiveness of reform and student learning in schools.

-Teachers are the cornerstone of educational change and teachers-as-researchers is a concept that initiates, promotes, and sustains innovation and change.

To accomplish the major objective of empowering teachers to create innovative, effective, and culturally relevant curricula and pedagogy we have initiated a series of four-week summer workshops (1989, 1990, 1992) involving teams of teachers from middle and high schools and an administrator from each school. Each year, past participants are invited to attend the workshops, and approximately 50% of them return. The curriculum design of these workshops emphasizes the principles of multicultural education, cross cultural experiences, review of the major reform efforts in science education, constructivist epistemology (von Glasersfeld, 1989), self-examination of beliefs about students and learning, cooperative learning and problems-solving models of pedagogy, and the exploration of models for community and family involvement in education. The goal of the summer workshops was for the teachers to utilize the information and experiences gained from these activities to create short (2-3 day) and long (2-3 week) curriculum units which were presented and critiqued by the entire group. The resulting refined curriculum units exist in a large data base and are being field-tested in the teacher's classrooms during the academic year and in summer school. Additionally, the teachers have formed action research groups to identify and seek resolution to problems in their schools and classrooms.

The academic year component of the project includes quarterly meetings of the entire group with university and public school personnel to share classroom experiences, results of field-testing the curriculum units, to seek assistance in refining curriculum and pedagogy, and to report on action research projects. Concurrently, the university personnel and the science supervisor for the public school district visit

each teacher's classroom throughout the year to consult and provide feedback regarding the progress of project goals.

During the summer of 1991, lacking both Eisenhower and National Science Foundation funding, six of the past workshop participants taught in the public school summer school program. They were supported by their school district and the university. Their students included approximately 200 high schools students, nearly all of whom had failed science during the academic year. Their goal was to develop non-text based courses to implement some of the innovations they had learned and to field-test the curriculum that had been developed. In addition, these teachers were supported by three university personnel and seven other workshop participants who assisted in the classrooms, on field trips, and in the evaluation of the curriculum and classroom experiences. Two of these teachers continued this aspect of the project during the 1992 summer school sessions.

National Science Foundation funding began in January, 1992, allowing the part time release from their classrooms of six of the workshop participants (this number will increase to 10-15/year during the last two years of the grant.). They meet on a weekly basis to reflect on their work, continue to develop and refine curriculum, serve as peer coaches in classrooms, and to field test the curriculum modules in their own classrooms and in the classrooms of peer participants in the project. In addition, they have begun to take leadership roles in the planning and implementation of the quarterly whole-group meetings, and for the summer 1993 workshop. They continue to initiate and develop community relationships and resources for teachers to utilize in their classrooms, disseminate information about the curriculum being developed, and to submit proposals to present their work at state and national conferences. These teachers were major partners in the planning and presentations for the summer 1992 workshop.

When the NSF funding ends in 1994, it is anticipated that these teachers (approximately 50% of the secondary science teachers in the Omaha Public Schools) will have developed, field-tested, and refined innovative and culturally relevant curriculum for use in grades 7 - 11 in their school district. The two major strands in the curriculum development component of the project are in life and physical sciences, with emphasis on inter- and multidisciplinary thematic units. Although this district has developed a prescribed set of outcomes for each science class, they allow teachers the freedom to develop their own strategies for reaching those outcomes. It is the goal of this project to provide attractive, relevant alternatives for all teachers in this district, as well as for teachers in other districts.

The curricular units are based on thematic units in a manner that all students and teachers can choose from a myriad of alternative activities that support these themes. The past participants have been encouraged and supported to attend and share activities from other nationally funded programs such as CEPUP (University of California, Berkeley), Earth Systems Education (Ohio State University) and GenEthics (Ball State University). In addition, detailed lists of community organizations, resources, and role models who may augment the curriculum units, are being made available to all of the teachers in the project and in the district. Work continues to explore and develop ways to involve the families of students in their schooling and to infuse these ideas into the curriculum.

This project is an example of a partnership between a university and a school district designed to focus on science education reform. The next steps require continued support for peer mentoring and increased institutionalization of the curriculum and staff development to sustain the changes without extensive outside support. To reach this goal, the released-time teachers will be working with district staff development personnel to plan for mechanisms to introduce the new curriculum and instructional strategies to other science teachers in the district.

What Have We Learned?

This complex program of teacher enhancement and curriculum reform was primarily developed with the needs of teachers and students in mind. Additionally, as researchers, we were interested in learning more about how teachers make sense of their thoughts and actions and about curriculum and teacher change. A qualitative study of the summer workshops and academic year components from 1989 to 1990, and a critical ethnographic study of three of the participants during 1991-92 indicates that there are many avenues to facilitate teacher learning and the implementation of culturally relevant science education. Among the most relevant findings were the following:

-Teachers must be at the heart of the change process. They must be involved in the creation, design, and field-testing of curriculum within the context of their school environment. This strategy encourages feelings of ownership and self-reliance rather than dependence on university or school administrative support systems.

-Teacher enhancement depends on allowing teachers to reflect on their beliefs and practices. Teachers must encounter safe situations in which they can reflect on their personal theories and cultural myths in relationship to the curricula and teaching strategies they want to change. By confronting teacher metaphors and critical events in teaching, teachers may be able to envision ways to change their environment and deal with the contradictions and tensions found in the profession. Our studies indicate that belief systems are more or less "in progress". For example, initially the data from classrooms portrayed the metaphors of 'banking' teacher and 'teacher as guide', but later, the classroom transcriptions began to illustrate a shift to teacher as 'facilitator' and teacher as 'coach'.

-Reflective practice and critical action research symbolize important changes in our ways of thinking. Providing time, opportunities, and encouragement for teachers to become researchers who distribute knowledge as well as produce knowledge will provide what Schon (1987) calls "schools that learn for themselves". As teachers begin to expose their beliefs and practical arguments through reflection and action research, they may accumulate evidence that will improve their premises. Without changes in mindsets, restructuring will not occur.

-Reflection and action research imply that teachers must collaborate, interact, and have conversations about classroom interactions, instructional strategies, and the relationships between school culture and power. Peer mentoring plays an important role in the implementation and continuation of curriculum innovations.

A second study, grounded in the anthropological studies of Ogbu and Fordham, is under way to examine the interactions between white teachers and students of color

and data from 1992 is being analyzed for patterns of language and communication through discourse analysis. Regardless of the nature of the research studies, the participants in the project are intimately involved in them, and possibly because of these involvements, are undertaking their own action research studies. As they continue to reflect and analyze present and future studies, it is apparent that the strength of this project, and maybe the hope for sustained implementation of teacher enhancement projects lies with the reconceptualization of the teacher as researcher in their own classrooms and where research is seen as a form of learning.

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For further information contact:

Dr. Judith Johnson
University of Central Florida
College of Education
Orlando, Florida 32816

Carol Mitchell
Omaha Public Schools
3215 Cuming
Omaha, Nebraska 68131

Dr. Elizabeth Kean
118 Henzlik Hall
Universiity of Nebraska, Lincoln
Lincoln, Nebraska 68588